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21a NAME OF RESPONSIBLE INDIVIDUAL A. E. Barrios	21b TELEPHONE (If applicable) (619) 553-1429	21c GRADE OR MSG NO Code 543

  

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## A TERRAIN PARABOLIC EQUATION MODEL (TPEM)

Amalia E. Barrios

Naval Command, Control and Ocean Surveillance Center

RDT&E Division, Code 543

San Diego, CA 92152-5000

A numerically efficient method has been developed to model tropospheric radiowave propagation over irregular terrain in the presence of range-dependent, non-standard environmental conditions. The model is based on a modification to the smooth-earth parabolic equation, and uses the split-step Fourier algorithm developed by Hardin and Tappert (*SIAM Rev.* 15, p. 423, 1973).

For radiowave propagation over terrain, the parabolic equation (PE) is subject to a range-dependent boundary condition, specifically, that the field is zero at the surface (assuming horizontal polarization). Since the surface is constantly changing for any arbitrary terrain, this poses a formidable problem. The method developed here is based on "transforming" the PE through a change of variables and determining a new "modified" PE with a new *range-independent* boundary condition that is now easily solved. This transformation is equivalent to defining a new modified refractivity that includes a term based on the second derivative of the terrain. Conceptually, the modified refractivity, which normally accounts for the earth's curvature, is now used with an additional term to take into account the radius of curvature of each segment of the terrain.

Comparisons are made between TPEM and other existing terrain models, and against measured data. The figure below is a coverage diagram from TPEM for a terrain path in Alberta, Canada.

